Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **October/November 2022**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	<u>'List rule' guidance</u> For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Examples of how to apply the list rule: State three reasons … [3]

A

1	Correct	✓	**2**
2	Correct	✓	
3	Wrong	×	

C

(4 responses)

1	Correct	✓	**2**
2	Correct, Wrong	✓ ×	
3	Correct	ignore	

E

(4 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct, Wrong	✓	

G

(5 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct Correct CON (of 4.)	✓ ignore ignore	

I

(4 responses)

1	Correct	✓	**2**
2	Correct	×	
3	Correct CON (of 2.)	✓ (discount 2)	

B

(4 responses)

1	Correct, Correct	✓ ✓	**3**
2	Correct	✓	
3	Wrong	ignore	

D

(4 responses)

1	Correct	✓	**2**
2	Correct, CON (of 2.)	× (discount 2)	
3	Correct	✓	

F

(4 responses)

1	Correct	✓	**2**
2	Correct	✓	
3	Correct CON (of 3.)	× (discount 3)	

H

(4 responses)

1	Correct	✓	**2**
2	Correct	×	
3	CON (of 2.) Correct	(discount 2) ✓	

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;	separates marking points
/	alternative answers for the same marking point
R	reject
A	accept
I	ignore
AVP	any valid point
AW	alternative wording (where responses vary more than usual)
ecf	error carried forward
underline	actual word underlined must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point

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Question	Answer	Marks
1(a)(i)	C-N bond shown **;** =O shown on C and -H shown on N of peptide group **;** water shown as a product **;**	**3**
1(a)(ii)	peptide **;** **A** amide **R** polypeptide bond	**1**
1(a)(iii)	ribosome **;** **I** 70S / 80S **A** rough endoplasmic reticulum **I** rough ER / RER	**1**
1(b)(i)	*any **two** from:* alpha- / α-, helix, helices **;** **R** A or a *for alpha* beta- / β-, pleated sheet(s) / pleat(s) **;** **A** beta / β, sheet(s) **R** B or b f*or beta* region of no fixed shape / AW **;** **A** random coil	**2**

Question	Answer	Marks
1(b)(ii)	*any **two** from:* **1** protein is, a single polypeptide / made of one chain of amino acids **or** quaternary structure is two or more polypeptides / more than one polypeptide **;** **2** interactions / bonds, between, R-groups / side chains, (of amino acids) on the same polypeptide **or** **3** quaternary has, interactions / bonds, between, R-groups / side chains, (of amino acids) on different polypeptides **;** **4** AVP **;** e.g. no prosthetic group	**2**
1(b)(iii)	*secondary structure* **1** in alpha-helix each N-H forms hydrogen bond with C=O three or four amino acids apart in same polypeptide **;** **2** in beta-pleated sheet each N-H forms hydrogen bond with C=O on adjacent part of the polypeptide **;** *if mp1 or mp2 not awarded* **3** (by) hydrogen bonds (in secondary structure) **;** *tertiary structure* **4** hydrogen bonds between, R-groups with C=O and HN groups / carboxyl and amine groups **;** **A** between polar R groups **5** ionic bonds between R-groups with NH_3^+ and COO^- groups **;** **A** between charged R groups / AW **6** hydrophobic interactions between non-polar R-groups **;** *if mp4, mp5 or mp6 not awarded* **7** (named) interactions / bonds, between R-groups (in tertiary structure) **;**	**3**

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Question	Answer	Marks
2(a)(i)	*any **three** from:* **1** phagocytosis / endocytosis **;** **2** (antigens on) bacteria, attach / bind, to cell (surface) membrane / receptors **;** **I** 'bonding' / binding sites **A** in context of, opsonins / antibodies, attached to bacteria **3** infolding / invagination / pinching in of membrane / AW **;** **A** pseudopodia / cytoplasm, moves around bacteria **4** fusion of membrane of macrophage (to form vacuole) **;** **5** formation of, vacuole / vesicle / phagosome **;** **6** active process / uses ATP / uses energy **;** **R** active transport **I** lysosomes	**3**

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Question	Answer	Marks
2(a)(ii)	*any **three** from:* *lysosomes contain enzymes* **1** (lysosomes contain enzymes) to, break down / digest / AW, pathogens / bacteria / viruses **;** **2** (lysosomes contain enzymes) to break down, worn out / old / non-functioning, organelles / cell components **;** **A** named organelle / worn out cells / old cells / ref to autolysis **3** using, hydrolytic enzymes / hydrolases **or** any **two** examples of enzymes **;** e.g. nuclease / protease / carbohydrase / lipase / glycosidase / lysozyme **4** isolate harmful enzymes from rest of the cell / membrane-bound to protect rest of cell (from hydrolytic enzymes) **;** **5** AVP **;** e.g. maintaining acid environment / optimum pH, for enzyme action ref. allows antigen presentation	**3**
2(b)(i)	*any **two** from:* *if working and numerical answer shown correctly but no minus sign or decrease stated = 2 marks* (number of new cases in 1993) 25 000 – 25 100 **and** (number of new cases in 2018) 8000 – 10 000 **;** percentage change = $\frac{16\,000}{25\,000}$ x 100 **;** answer = - 64(%) / decrease by 64(%) **;** **A** answer between – 60 and – 68 (%)	**3**

Question	Answer	Marks
2(b)(ii)	*any two from* **1** (number of new cases overall) decrease **;** **2** steep(er) decrease between 1993 and 2001 **;** **3** (number of new cases) constant / stable / plateau, between, 2013 / 2014, to 2018 **;** **4** (number of new cases) increases in 2015 **;** **I** fluctuation for mp3 and mp4	**2**
2(c)	*any **one** from:* **I** references to (more) accurate can make, statistical / valid, comparisons between, years / countries **;** **A** takes into account the population sizes of different countries AVP **;** e.g. can set targets for the control of TB (e.g. keep below *n* per 100 000) ref. to supply of, vaccines / drugs / hospital beds / AW can, monitor / evaluate, success of TB control programmes to find out which countries have high, rates / incidence, of TB **R** 'high numbers'	**1**

Question	Answer	Marks
2(d)	*any **two** from:* **1** *Mycobacterium* / pathogen / TB bacteria, remains dormant in the body **;** **A** ref. to latent TB / bacterium present in the body but no symptoms **2** treatment takes a, long time / minimum of 6 months **;** **3** many people do not complete treatment **;** **4** many people do not have access to treatment **;** **5** drug-resistant / antibiotic resistant, strains of *Mycobacterium* / pathogen / TB bacteria **;** **R** 'immune' **6** HIV/AIDS *or* any other medical condition that increases susceptibility to TB **;** e.g. weakened immune system / increased activation of dormant bacteria **I** TB is opportunistic, infection / disease, without further detail **7** vaccine reluctance **;** **8** movement / migration, of people, infected with TB / from countries with high rates of TB **;** **9** poor housing / overcrowded living conditions / homelessness **;** **10** malnutrition / poor diet **;** **11** transmission from cattle by, drinking unpasteurised contaminated milk / eating meat from contaminated cattle **;** **12** lack of education / AW, about preventing spread of TB **;** **13** AVP **;** e.g. vaccination is not effective for adults / AW TB is difficult to diagnose	**2**

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Question	Answer	Marks
3(a)	*any **four** from:* **1** ref to, difference in water potential / water potential gradient **;** **2** (continuous) columns of water (in xylem of, tree trunk / stem) **;** **I** stream **3** transpiration pull / cohesion-tension **;** **4** hydrogen bonding / cohesion, between water molecules **;** **5** hydrogen bonding / adhesion, between water and, the lining of the xylem / cellulose (in walls of xylem) / hydrophilic parts of lignin **;**	**4**
3(b)	*any **four** from:* **1** cavitation (only) occurs when, light is available / PAR is available / the trees photosynthesise **;** **2** water movement / transpiration, (only) occurs when, light is available / PAR is available / the trees photosynthesise **;** **3** no clear relationship between values for, light energy / PAR, and cavitation rate **;** **4** peaks of cavitation does not coincide with peaks for, PAR / wind speed **;** **A** peaks occur around the time of peak in, PAR / wind speed **5** no cavitation when the wind speed is below 1.25 $\underline{\text{m s}^{-1}}$ **;** **6** PAR affects, cavitation (rate) / water movement / transpiration (rate), more than wind speed **;**	**3**

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Question	Answer	Marks
4(a)(i)	**A** – <u>metaphase</u> **;** **B** – <u>anaphase</u> **;**	**2**
4(a)(ii)	*any **three** from:* *prophase* **1** form spindle, apparatus / fibres **;** **2** attached to, centromere / kinetochore **;** **A** remain attached to centromere during, prophase / metaphase / anaphase *(late) prophase* **3** move / AW, chromosomes / sister chromatids, to, (spindle) equator / metaphase plate **or** *during metaphase / until anaphase* maintain chromosomes at (spindle) equator **;** **A** sister chromatids **R** chromatids unqualified *anaphase* **4** disassembly / shortening, of microtubules / spindle fibres **;** **5** centromeres divide **or** chromatids move to (opposite), poles **;** AW **R** sides **6** daughter nuclei receive, one chromatid of each chromosome **;** **A** daughter nuclei receive a full complement of chromosomes / AW **7** AVP **;** e.g. pole to pole spindle fibres lengthen to extend the cell	**3**

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Question	Answer	Marks
4(a)(iii)	**I** telophase *any **three** from:* **1** nuclear envelope (re)forms around each group of chromosomes **;** **R** nuclear membrane **2** uncoiling / decondensing / AW, of chromosomes **;** **A** ref. to chromatin **3** nucleolus / nucleoli (in each nucleus), reform(s) / reappears / visible **;** **4** organelles distributed between two halves of cell **;** **5** cytokinesis / division of cytoplasm **; A** cytoplasm splits **6** cleavage furrow forms **;** **A** described e.g. 'pinching in' of (cell surface) membrane **A** equator of cell pinches in / cell membrane constricts **R** cell plate **7** AVP **;** e.g. ref to ring of microfilaments / contractile ring, draws membrane closer together / AW **I** microtubules	**3**

Question	Answer	Marks
4(b)	*any **three** from:* **1** semi-conservative replication of DNA **;** **2** *idea that* each new chromatid is identical to old one / sister chromatids are identical **or** each chromosome has two identical DNA molecules **;** **3** alignment of chromosomes on the, (spindle) equator / metaphase plate **;** **4** chromatids separate so each cell receives a (sister / identical) chromatid of each chromosome **;** **5** centromere(s) split / shortening of spindle fibres **;** **6** sister / identical, chromatids move to (opposite), poles **;** AW **A** chromosomes / daughter chromosomes **7** checkpoints occur within cell cycle **;** **8** prevents cells entering next stage if there are errors **;** **9** (so that) errors in replication are repaired (by DNA polymerase) **;** **10** to avoid mutations in daughter cells **;**	**3**

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Question	Answer	Marks
5(a)(i)	*any **two** from:* **1** *idea of* the cells have the, same receptor / specific receptor (for LL-37) **;** **2** on cell (surface) membrane / inside cell **;** **3** (shape of) receptor is complementary to (shape of), cathelicidin / signalling compound / ligand **;** **I** antigen **R** active site	**2**
5(a)(ii)	*any **two** from:* **1** thin cells **;** **A** (they are) squamous **R** 'made of squamous epithelial cells' **I** flat / flattened **R** 'they have thin (cell) walls' **2** smooth / AW, (luminal) surface **;** **3** cells are wider in region of the nucleus **;** **A** nucleus bulges from cell **4** ref to, endothelial pores / fenestrations / pores between cells / gaps between cells **;**	**2**
5(b)(i)	(TTC to TAC) change from phe to tyr (at position 5) **;** **I** 'tyr' unqualified	**1**

Question	Answer	Marks
5(b)(ii)	*allow two marks for* new sequence is leu arg val ile ser ser gly asp leu **;;** *or allow any **two** from:* **I** refs to frameshift **1** sequence after, first amino acid / first leu, is different **;** **R** 'after position 2' **A** 'from position 2 onwards' **2** any example **;** e.g. amino acid (at position 2) is arg **3** shortened polypeptide / early chain termination **;**	**2**
5(b)(iii)	*any **two** from:* peptide is 3 amino acids in length / shortened polypeptide **;** stop codon in position 4 **;** (third) amino acid is still, gly(cine) / the same **;**	**2**
5(c)	(genetic code) is the, same / similar, in all organisms AW **or** *idea that* each triplet codes for the same amino acid in all living organisms **;**	**1**
5(d)	*any **two** from:* **1** (most) amino acids have more than one, triplet / codon **;** **2** any correct example(s) from Table 5.2 **;** *if award this then award mp1 as well* **3** genetic code is, degenerate / redundant **;** **R** degenerative / degenerated **4** *idea that* 64 / 61, possible codons for 20 different amino acids **;**	**2**

Question	Answer	Marks
6(a)	*any **one** from:* **1** (ions) cannot pass through, phospholipid bilayer / hydrophobic core (of membrane) **; ora** **I** 'ions cannot pass through the membrane' **2** (transport proteins provide a) hydrophilic pathway for ions **;** **3** for facilitated diffusion (of the two ions) **;** **A** to act as an anion exchanger	**1**
6(b)	to maintain electrical neutrality (inside cytoplasm / cell) **;** **A** balance the charges (either side of membrane) **A** to prevent build up of negative charge (in cytoplasm) **I** 'because HCO_3^- are moving in' **I** ref to pH	**1**

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Question	Answer	Marks
6(c)	*any **one** from:* **1** concentration of carbon dioxide is lower than concentration in red blood cell **or** carbon dioxide, diffuses / AW, down a concentration gradient **;** **A** partial pressure **2** so carbon dioxide can be, excreted / expelled from lungs / breathed out **;** **3** to enter the alveolus / alveolar (air) space **;** **4** as part of gas exchange, at the alveolar surface / in the lungs **;**	**1**
6(d)	**X** = haemoglobinic acid **; I** HHb	**1**

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